RI Work Plan ASARCO, "Gould Property"
JMZ Geology July 2001

~~Pgs~~ Pgs. 5-9, 16-17
Fig. 1, 7

photos. However, the July 14, 1940 aerial photo shows a road entering the South Property from the ASARCO plant into an area that is currently underlain by slag. In this photo, the slag is confined to the area to the north of the meandering course of Crane's Creek. No stream crossing is seen on this photo. It is uncertain whether the slag is this area was deposited on natural marsh soils, dredge spoils, or some other artificial fill material. The distribution of slag on the north side of Crane's Creek seen in the 1940 aerial photo suggests that this material is older than accumulations placed after the construction of a stream crossing.

2.2.4 ASARCO Purchases the South Property

In December 1940, ASARCO purchased the majority of the South Property from the Lehigh Valley Railroad with the intention of using it as a slag yard (Pearce, Appendix E). Figure 4 illustrates the historical features of the South Property at approximately the time of its sale to ASARCO. Following ASARCO's purchase of the property, the eastern portion of the Creek was straightened and a crossing was installed. Extensive slag placement took place during the period from approximately 1951 to 1976 (based on aerial photography). A map (ASARCO, 1950b) indicates that "gravel" was removed from the hydraulic fill area prior to the placement of slag (see Figure 5).

In addition to the slag yard, ASARCO constructed and used two ponds on the South Property during its ownership. These are referred to as the "acid pond" and the "overflow pond". The remnants of the two ponds are currently visible as two broad, shallow depressions on the property surface. The locations are illustrated on Figure 3. The acid pond was a rectangular earthen structure located to the north of Crane's Creek. The structure is identified as an "acid pond" on an ASARCO map from 1954. The acid pond was used for the disposal of spent electrolyte from the copper tank house operation. The pond measured approximately 100 feet by 75 feet. Aerial photos suggest that it was a bermed structure built on top of the slag rather than excavated into it.

The acid pond is not present in aerial photos from 1940 or 1951. The earliest record of its presence is the 1954 map. It is present and appears to be liquid filled on the photos from 1959, 1970, and 1976. In the 1979 photo the pond is present but appears to be dry. In the 1986 photo the outline of the pond is visible but it appears to have been filled. In the 1994 photo, no indication of the pond is visible. Recent field reconnaissance has identified a shallow, unvegetated depression at the location of the acid pond.

The overflow pond was located to the southeast of the acid pond, on the south side of Crane's Creek. It was a more or less rectangular structure measuring approximately 125 feet by 80 feet. This feature is visible on aerial photos from

1970, 1976, and 1979. An elevated pipeline appears to connect the overflow pond with the acid pond. In the 1979 photo, the overflow pond contains liquid although the acid pond appears to be dry. In the 1986 photo, the outline of the overflow pond is visible. In the 1994 photo, the location has been regraded and no indication of the overflow pond is visible. Recent field reconnaissance has identified a shallow, grass-covered depression at the location of the overflow pond. The remains of an elevated, tray-supported, 2-inch hose originating at the acid pond, crossing Crane's Creek, and terminating at the overflow pond have also been identified.

The physical connection of this feature with the acid pond location suggests that it was an overflow basin or perhaps a secondary neutralizing basin. NJDEP personnel observed this pipeline on September 22, 1976 (NJDEP, 1976) and confirmed the connection between the two ponds, noting the green color of the liquid (possibly nickel sulfate). However, no documents are available which clearly indicate or describe the overflow pond's construction or purpose.

A number of proposed development plans (ASARCO, 1940, 1950a, 1954a & b, 1971) suggest that the slag was deposited in the slag yard as structural fill placed on the South Property in advance of planned construction. However, none of the ASARCO development plans for the South Property were ever implemented. ASARCO ceased using the slag yard, including the acid and overflow ponds, during the 1970's and did not conduct any further activities on the South Property thereafter.

Aerial photps and on-site inspection indicate that the portion of the South Property immediately adjacent to Block 254 Lot 1.02 was encroached upon by dumping conducted by NL Industries, Inc. Block 254 Lot 1.02 was owned by ASARCO from 1940 to 1948 at which time it was sold to National Lead Co. (predecessor of NL Industries). There are no records or field-visible indications that ASARCO used Block 254 Lot 1.02 for any purpose during its brief period of ownership. In 1981, NL Industries, Inc. submitted a Notification of Hazardous Waste Site to USEPA. The notification states: "Slag and battery casings from secondary lead smelter operations disposed of on site". However, the notification does not specify the disposal location; it does state that the activity ceased in 1976. Soil boring location maps prepared by ERM (see Section 2.4.1 below) in conjunction with aerial photos suggest that the primary area of disposal was located on Block 425 Lot 1.02, and that NL disposed of slag and battery casings on this lot between 1970 and 1976. In the 1970 photos the area in question is uniformly vegetated. In the 1976 and 1979 aerial photos this area is covered with graded black material and is connected by a roadway to the mid-section of the NL plant. This material has been graded across the property line onto Block 254 Lot 1.01. Recent field reconnaissance confirmed the presence of crushed battery casings and granulated

black slag in this portion of the South Property. Battery casings and granular slag extend approximately 750 feet eastward along the south bank of Crane's Creek. Additional pockets of battery casings and black granular slag are found throughout the South Property and appear to be the result of later grading and reworking during the period when the South Property was owned by N. Brown. None of the above disposal activities are related to ASARCO's ownership or use of the property.

Hydraulic fill was used on the South Property during a number of filling episodes conducted before, during, and after ASARCO's period of ownership. Dredging was conducted adjacent to the South Property as eariy 1909 (see section 4.0 below) but little documentation as to the deposition of the spoils is available. Hydraulic fill is evident in aerial photos from 1940 and 1951. The hydraulic fill was used to cover the salt marsh and raise the elevation of the South Property. This elevated surface was then used for slag placement. In the 1959 photo, older hydraulic fill is being covered with slag. One map (ASARCO, 1971) shows the northeast quadrant of the South Property specifically reserved for the placement of dredge spoils. Additional hydraulic filling is evident in aerial photos from 1970.

Recent field reconnaissance identified hydraulic fill materials over the majority of the South Property surface. The hydraulic fill typically contains sand, rounded quartz gravel, and abundant shells. A large portion of the newer slag yard is covered with this fill. Different hydraulic fill cells are divided by dikes which are generally composed of similar materials, all consistent with dredge spoils. These are fine-grained sediments, composed of silt and sand with only traces of gravel, but with a visually-significant component of white shell material.

2.2.4 Neuburne Brown Purchases the South Property

Based on aerial photo evidence, additional filling and grading was conducted during the oeriod of 1979 to 1983 following the sale of the property to N. Brown & L.C. Peters. Hundreds of truck loads of piled material are visible on the South Property surface in aerial photos taken during this time. The source of this fill material is unknown. Examination of the overgrown remnants of this dumpihg shows soil, asphalt, concrete, meadow mat and short sections of treated poles are contained in this material. The bulk of the material deposited during this period has since been regraded by Stolt Terminal, Inc. to prepare a dredge spoil settling basin. Throughout the period that the South Property was owned by N. Brown it remained undeveloped. Also during this time, Brown purchased the riparian rights to the property from the State of New Jersey.

2.2.5 Stolt Terminals, Ino. purchases the South Property

Significant amounts of regrading and some filling were conducted following the 1983 purchase of the South Property by the current owner, Stolt Terminals (Perth Amboy) Inc. Based on aerial photos, the Eastman Chemical building currently located on the South Property was constructed between 1983 and 1986. A photo in an article about the sale of the South Property in April 14, 1983 issue of The News Tribune shows no buildings present at that time. However, in the area in which the building would be constructed an irregular patch of light colored, highly reflective material is present. This may be new fill material brought in anticipation of construction.

In the 1986 aerial, the building is complete and is clearly operational and active. No additional buildings are present in any of the subsequent photos. To the south of the building is a large pile of white material. Approximately one-half of the pile appears to have been removed. Based on file review information, this material is believed to be either sodium chloride or calcium carbonate (aragonite).

In September 1988, Stolt Terminals applied for a permit to dredge one existing and one proposed pier area on the Arthur Kill, to the south of the Outerbridge Crossing. The application included plans for the construction of a dredge spoils disposal settling basin on the South Property. The proposed basin was designed for the disposal of approximately 18,000 cubic yards of dredged sediment. It consisted of raised berms enclosing an area of 3.8 acres. Permit documents, chemical characterization and plans are provided in Appendix D. Aerial photos indicate that the settling basin was constructed immediately to the east of the Eastman Chemical building on top of previously deposited slag and other fill material placed during Neuburne Brown's ownership. Although the basin was planned with straight sides measuring approximately 300' by 575', the eastern edge of the constructed basin is free-form in shape, and the basin's area is greater than planned.

In the 1994 aerial, the white material has been removed and the area regraded. A new diked area is present to the east of the building. This is the dredge spoils disposal basin used during the dredging conducted by Stolt. This basin is still in use for dewatering dredge spoils (see Figure 3).

2.3 Additional Documentation of Historical Slag Placement and Distribution

As previously noted, ASARCO evaluated the South Property for the possible expansion of smelting operations. Though none of these plans were ever realized, geotechnical borings were installed on three occasions for foundation engineering purposes. Documentation of the following investigations has been found in ASARCO files: Healy, 1951; Raymond Concrete Pile, 1954; and Dames and Moore,

1954. Logs of the borings installed during these investigations show the distribution of slag at that time. Figure 6 is a property map showing the locations of the borings made during these investigations. Note that Figure 6 was constructed by superimposing locations from historic maps onto a recent base. Therefore the locations of the borings are approximations only. As previously noted, Figure 5 shows the location of hydraulic fill areas and the maximum extent of slag on the South Property. The map was compiled on the basis of the historical and photographic data outlined in this and the preceding section.

2.4 Summary of Previous Environmental Investigations

At least five investigations have been conducted on the South Property since 1978. These are:

Ralph S. Ward, Inc., 1978	*for* Outerbridge Terminal, Inc.
Leonard Engineering, 1982, 1984	*for* Outerbridge Terminal, Inc.
ERM, 1980	*for* Outerbridge Terminal, Inc.
Environics, 1984-1985	*for* Stolthaven Terminals, Inc.
Roy F. Weston, 1990-1991,	*for* Stolt Terminals, Inc.
CDM, 1995	*for* Witco Corporation

JMZ Geology has reviewed documents pertaining to each of these investigations. However, these investigations were not designed to evaluate the entire South Property. The Ralph S. Ward and Leonard Engineering investigations were geotechnical in nature. The ERM, Environics, and Roy F. Weston investigations focused on the central portion of the South Property where the most recent accumulation of ASARCO slag is located. This area is referred to as the "newer slag yard" in Section 4.2 below. The CDM investigation (and remedial action) was focused on polychlorinated biphenyls (PCBs) discharged into Crane's Creek through the Perth Amboy municipal sewer system.

A brief discussion of each of these investigations is provided below. Relevant portions of the reports are provided in Appendix F. The locations of monitoring wells and soil borings installed during these investigations are illustrated on Figure 6. As noted above, Figure 6 was constructed by superimposing locations from historic maps onto a recent base.

2.4.1 Ralph S. Ward, 1978 & Leonard Engineering, 1982 and 1984

Both of these investigations were geotechnical in nature. The Ward investigation was conducted for Outerbridge Terminal, Inc. (a.k.a. N. Brown and L.C. Peters) prior to their purchase of the property in 1978. The Leonard Engineering

identified. However, additional investigation is necessary to fully evaluate the groundwater quality at the South Property.

4.1 Area 1: Older Slag Yard

As noted in the historical summary, an agreement was made between ASARCO and the LVRR in 1910 to allow the storage of slag on the South Property. The exact date that slag placement began is unknown. However, aerial photos indicate that at least two distinct modes of slag emplacement occurred. Based on the photos, one mode occurred prior to purchase. The 1940 aerial photo shows a road entering the South Property from the ASARCO plant into a slag-covered area to the north of the meandering course of Crane's Creek. This area represents the "older slag yard".

The thickness of the slag on this portion of the South Property is not precisely known. However, based on borings on adjacent portions of the ASARCO plant site, a thickness of 8 to 10 feet is estimated. It is also unknown if the slag was placed directly on natural marsh soils or on previously deposited fill materials. Recent field reconnaissance suggests that the stratified ferrous slag observed on the north bank of Crane's Creek may be present beneath the surficial non-ferrous slag. It is also possible that hydraulic fill may be present beneath the surficial slag as in the newer slag yard. After purchase of the South Property, the eastern portion of Crane's Creek was altered to its current alignment, and recent inspection shows that it flows through deposits of non-ferrous slag.

4.2 Area 2: Newer Slag Yard

With the older slag yard re-graded, Crane's Creek realigned and a crossing culvert in-place, slag was then transported to areas that had been previously filled with hydraulic fill. Photos show that during the period of 1951 to 1976 a large surface area of the South Property was covered with slag. Deposition of slag had begun at the Crane's Creek culvert and proceeded southward in a radial fashion.

Boring logs from the 1991 Roy F. Weston investigation indicate that the thickness of this material ranges from approximately 4.5 to 18 feet. Based on aerial photos and the development history, the upper surface of the slag had been extensively reworked prior to the 1991 sampling. Therefore, the slag thicknesses encountered may not represent the original deposited thickness. The material was described as consisting mostly of granular slag mixed with soil materials. In some locations, however, massive slag was encountered. Recent field reconnaissance found that in many locations the slag has been covered with more recent fill materials. These surficial materials include, hydraulic fill, demolition rubble, asphalt debris, excavated meadow mat, and black granulated slag.

The Weston report states that the slag was deposited on a series of beach and glacially-derived sands. This is incorrect. A review of geologic reports, aerial photos and historical documents indicates that the slag was deposited on top of an extensive layer of hydraulic fill. The hydraulic fill was placed over salt marsh in a series of events and some of this material most likely resulted from channel deepening or dredging adjacent to piers. The manmade nature of this fill has been confirmed by recent field observations.

4.3 Area 3: Former Acid Pond

As noted above, the acid pond was a rectangular earthen structure located near the north boundary of the South Property on the older slag yard to the north of Crane's Creek. The history and use of the acid pond was discussed in Section 2.2.4 above. The only remaining visual indication of the former acid pond is a shallow, unvegetated depression.

The historical use of the acid pond for the disposal of spent copper tank house electrolyte may have introduced dissolved inorganic contaminants to this portion of the South Property. In addition, the percolation of the acidic fluid through the existing slag may have mobilized metals already present.

4.4 Area 4: "Overflow" Pond

The overflow pond was located to the southeast of the acid pond, on the south side of Crane's Creek. The history and use of this pond was discussed in Section 2.2.4 above. The only remaining visual indication of the former overflow pond a shallow, grass-covered depression.

The historical use of the overflow pond and its connection to the acid pond may have introduced dissolved inorganic contaminants to this portion of the South Property. In addition, the introduction of acidic fluid into the underlying slag may have mobilized metals already present.

5.0 GROUNDWATER

Previous investigations have included preliminary evaluations of the South Property groundwater quality (see Section 2.4). Analytical results from these groundwater investigations are summarized on Table 1 A - E.

A total of twenty wells have been installed on the South Property in investigations conducted in 1980 (OT series wells), 1984-85 (wells SE-101 through -105), and 1990-91 (wells SE-120 through 125)(Weston, 1991). The locations of these wells are illustrated on Figure 6. The most recent of the groundwater investigations